

# 第四单元训练指导书

## 训练目的

- 掌握 UML 类图、顺序图、状态图的概念与要点，能够根据 UML 图提取信息；
- 掌握 StarUML 的基本使用方法，并能够绘制相关 UML 图；
- 掌握 mdj 文件与 UML 图的联系，能够从 mdj 文件中提取 UML 图的相关信息。

## 训练任务

本次训练部分将包含如下三个部分的训练题：

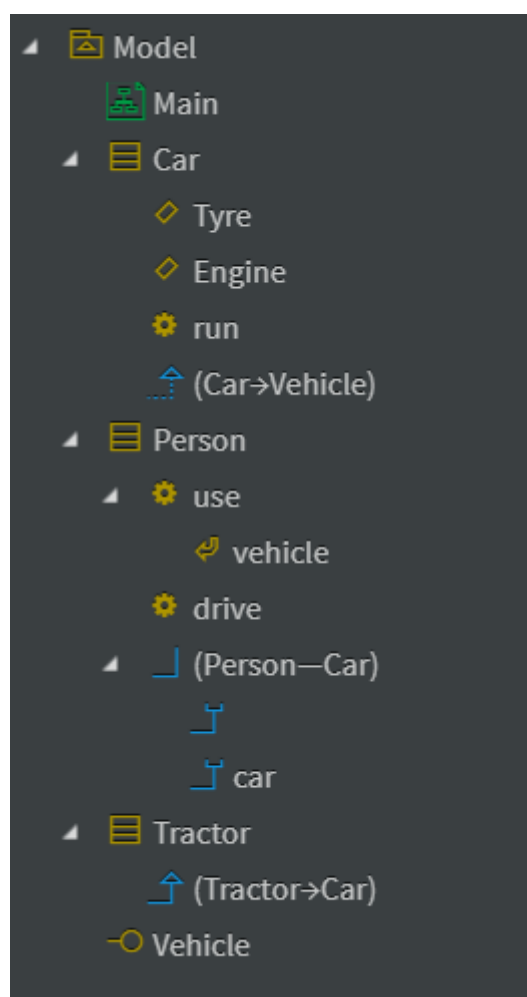
1. 类图训练题
2. 顺序图训练题
3. 状态图训练题

每个训练题部分包含 4 个大题，各大题下有若干个小题。同学们需要根据题目给出的信息，完成相关问题的填写。答案提交方式请参考后文 **提交方式** 章节。

## 类图训练题

### 题目 1

根据树形图回答问题。

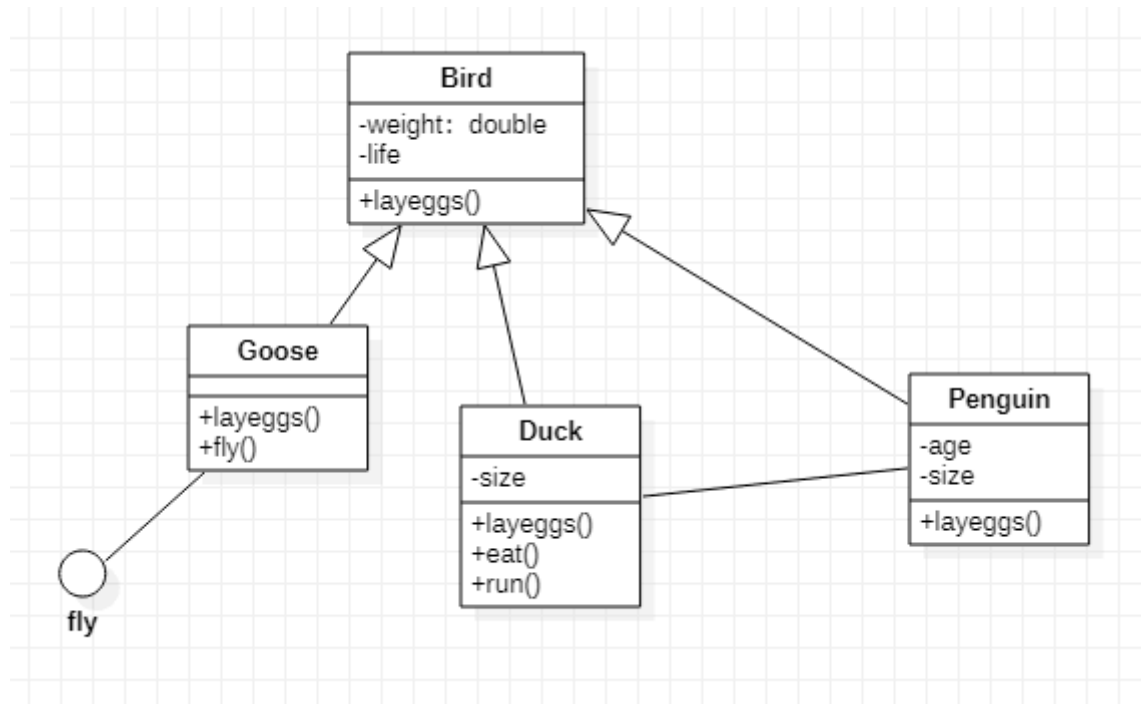


1. 类 `car` 有\_\_\_\_\_个属性，有\_\_\_\_\_个方法。

2. 类 `Car` 与类\_\_\_\_\_有关联关系。
3. 图中唯一的继承关系为由类\_\_\_\_\_继承类\_\_\_\_\_, 唯一的实现关系为由类\_\_\_\_\_实现接口\_\_\_\_\_。

## 题目 2

根据 UML 图回答问题。



1. 图中共有\_\_\_\_\_个类，其中类 `Duck` 有\_\_\_\_\_个方法。
2. 图中共有\_\_\_\_\_个继承关系。
3. 类 `Penguin` 有\_\_\_\_\_个属性。
4. 图中唯一的实现关系为类\_\_\_\_\_实现接口\_\_\_\_\_。

## 题目 3

根据给出的部分源代码回答问题。

```

1  {"_parent": "AAAAAAFF+qBWK6M3Z8Y=", "visibility": "public", "name": "Elevator", "_t
   type": "_____", "_id": "AAAAAAF18DIKq2p6jLg="}
2  {"_parent": "AAAAAAF18DIKq2p6jLg=", "visibility": "private", "name": "capacity", "_
   type": "UMLAttribute", "_id": "AAAAAAF18DWCwGqkohY=", "type": "int"}
3  {"_parent": "AAAAAAF18DZ3TWqvODQ=", "name": "floor", "_type": "UMLParameter", "_id
   ": "AAAAAAF18DbrIGq2/fc=", "type": "int", "direction": "in"}
4  {"_parent": "AAAAAAF18DIKq2p6jLg=", "visibility": "public", "name": "move", "_type"
   ": "UMLOperation", "_id": "AAAAAAF18DZ3TWqvODQ="}
5  {"_parent": "_____", "_type": "UMLParameter", "_id": "AAAAAAF18DdF62q6Yis=", "typ
   e": "boolean", "direction": "return"}
  
```

上述源码表示的是类 `Elevator` 的属性方法，那么源码中缺失部分应该依次填入\_\_\_\_\_、\_\_\_\_\_。

## 题目 4

根据给出的部分 mdj 源码回答问题。

```
1  {
2    "_type": "UMLClass",
3    "_id": "AAAAAAF8H/qgZRVLPsk=",
4    "_parent": {
5      "$ref": "AAAAAAFF+qBWK6M3Z8Y="
6    },
7    "name": "User"
8  },
9  {
10   "_type": "UMLClass",
11   "_id": "AAAAAAF8H/SG3hv1F3I=",
12   "_parent": {
13     "$ref": "AAAAAAFF+qBWK6M3Z8Y="
14   },
15   "name": "Reader",
16   "ownedElements": [
17     {
18       "_type": "UMLGeneralization",
19       "_id": "AAAAAAF8IAI3RRY6DZA=",
20       "_parent": {
21         "$ref": "AAAAAAF8H/SG3hv1F3I="
22       },
23       "source": {
24         "$ref": "AAAAAAF8H/SG3hv1F3I="
25       },
26       "target": {
27         "$ref": "AAAAAAF8H/qgZRVLPsk="
28       }
29     },
30     {
31       "_type": "UMLInterfaceRealization",
32       "_id": "AAAAAAF8IAZXmR1ubio=",
33       "_parent": {
34         "$ref": "AAAAAAF8H/SG3hv1F3I="
35       },
36       "source": {
37         "$ref": "AAAAAAF8H/SG3hv1F3I="
38       },
39       "target": {
40         "$ref": "AAAAAAF8IAL7zhzeScg="
41       }
42     },
43     {
44       "_type": "UMLAssociation",
45       "_id": "AAAAAAF8IapPMx7ZnGU=",
46       "_parent": {
47         "$ref": "AAAAAAF8H/SG3hv1F3I="
48       },
49       "end1": {
50         "_type": "UMLAssociationEnd",
51         "_id": "AAAAAAF8IapPMx7aBiM=",
52         "_parent": {
53           "$ref": "AAAAAAF8IapPMx7ZnGU="
```

```

54         },
55         "reference": {
56             "$ref": "AAAAAAF8H/sg3hv1F3I="
57         },
58         "multiplicity": "1"
59     },
60     "end2": {
61         "_type": "UMLAssociationEnd",
62         "_id": "AAAAAAF8IApPMx7bfs=",
63         "_parent": {
64             "$ref": "AAAAAAF8IApPMx7ZnGU="
65         },
66         "reference": {
67             "$ref": "AAAAAAF8IAut1B0nQ00="
68         },
69         "multiplicity": "1"
70     }
71 }
72 ],
73 "operations": [
74     {
75         "_type": "UMLOperation",
76         "_id": "AAAAAAF8IAabQh2ARXw=",
77         "_parent": {
78             "$ref": "AAAAAAF8H/sg3hv1F3I="
79         },
80         "name": "renew"
81     },
82     {
83         "_type": "UMLOperation",
84         "_id": "AAAAAAF8IAbcWR2H8PE=",
85         "_parent": {
86             "$ref": "AAAAAAF8H/sg3hv1F3I="
87         },
88         "name": "return"
89     }
90 ]
91 },
92 {
93     "_type": "UMLClass",
94     "_id": "AAAAAAF8H/tpCRwfVJg=",
95     "_parent": {
96         "$ref": "AAAAAAFF+qBWK6M3Z8Y="
97     },
98     "name": "Administrator",
99     "ownedElements": [
100         {
101             "_type": "UMLGeneralization",
102             "_id": "AAAAAAF8IAJxuRzLMg4=",
103             "_parent": {
104                 "$ref": "AAAAAAF8H/tpCRwfVJg="
105             },
106             "source": {
107                 "$ref": "AAAAAAF8H/tpCRwfVJg="
108             },
109             "target": {
110                 "$ref": "AAAAAAF8H/qgZRVLPsk="
111             }

```

```

112     },
113     {
114         "_type": "UMLAssociation",
115         "_id": "AAAAAAF8IAkUIh5Mpgs=",
116         "_parent": {
117             "$ref": "AAAAAAF8H/tpCRwfVJg="
118         },
119         "end1": {
120             "_type": "UMLAssociationEnd",
121             "_id": "AAAAAAF8IAkUIh5NZaU=",
122             "_parent": {
123                 "$ref": "AAAAAAF8IAkUIh5Mpgs="
124             },
125             "reference": {
126                 "$ref": "AAAAAAF8H/tpCRwfVJg="
127             },
128             "multiplicity": "1..*"
129         },
130         "end2": {
131             "_type": "UMLAssociationEnd",
132             "_id": "AAAAAAF8IAkUIh5O8UI=",
133             "_parent": {
134                 "$ref": "AAAAAAF8IAkUIh5Mpgs="
135             },
136             "reference": {
137                 "$ref": "AAAAAAF8H/sg3hv1F3I="
138             }
139         }
140     }
141 ]
142 },
143 {
144     "_type": "UMLInterface",
145     "_id": "AAAAAAF8IAL7zhzeScg=",
146     "_parent": {
147         "$ref": "AAAAAAFF+qBWK6M3Z8Y="
148     },
149     "name": "Borrow",
150     "attributes": [
151         {
152             "_type": "UMLAttribute",
153             "_id": "AAAAAAF8IANCBROJmzM=",
154             "_parent": {
155                 "$ref": "AAAAAAF8IAL7zhzeScg="
156             },
157             "name": "book_id",
158             "type": ""
159         },
160         {
161             "_type": "UMLAttribute",
162             "_id": "AAAAAAF8IAO/Qx0QcJs=",
163             "_parent": {
164                 "$ref": "AAAAAAF8IAL7zhzeScg="
165             },
166             "name": "id",
167             "type": ""
168         }
169     ],

```

```

170     "operations": [
171         {
172             "_type": "UMLOperation",
173             "_id": "AAAAAAF8IAQ5qB0X18c=",
174             "_parent": {
175                 "$ref": "AAAAAAF8IAL7zhzeScg="
176             },
177             "name": "renew"
178         },
179         {
180             "_type": "UMLOperation",
181             "_id": "AAAAAAF8IASGx0fMBA=",
182             "_parent": {
183                 "$ref": "AAAAAAF8IAL7zhzeScg="
184             },
185             "name": "return"
186         }
187     ]
188 },
189 {
190     "_type": "UMLClass",
191     "_id": "AAAAAAF8IAUt1B0nQ00=",
192     "_parent": {
193         "$ref": "AAAAAAFF+qBWK6M3Z8Y="
194     },
195     "name": "Book",
196     "attributes": [
197         {
198             "_type": "UMLAttribute",
199             "_id": "AAAAAAF8IAVOGx1RaEo=",
200             "_parent": {
201                 "$ref": "AAAAAAF8IAUt1B0nQ00="
202             },
203             "name": "id",
204             "visibility": "private"
205         },
206         {
207             "_type": "UMLAttribute",
208             "_id": "AAAAAAF8IAV38x1Z4h0=",
209             "_parent": {
210                 "$ref": "AAAAAAF8IAUt1B0nQ00="
211             },
212             "name": "name",
213             "visibility": "public"
214         },
215         {
216             "_type": "UMLAttribute",
217             "_id": "AAAAAAF8IAWPGx1gfcI=",
218             "_parent": {
219                 "$ref": "AAAAAAF8IAUt1B0nQ00="
220             },
221             "name": "author",
222             "visibility": "public"
223         },
224         {
225             "_type": "UMLAttribute",
226             "_id": "AAAAAAF8IAXZTh1nLug=",
227             "_parent": {

```

```

228         "$ref": "AAAAAAF8IAUt1B0nQ00="
229     },
230     "name": "price",
231     "visibility": "public"
232 }
233 ]
234 }

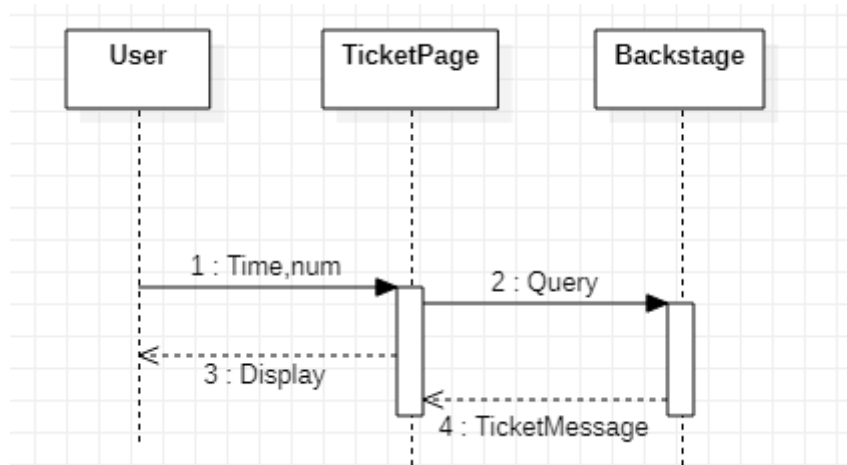
```

1. 在代码中共有\_\_\_\_\_个关联关系，其中对端个数为一对多的两个相互关联的类为类\_\_\_\_\_和类\_\_\_\_\_。（第一个空填被关联的类）
2. 类 `Book` 一共有\_\_\_\_\_个属性，其中属性 `name` 的可见性为\_\_\_\_\_，属性 `id` 的可见性为\_\_\_\_\_。

## 顺序图训练题

### 题目 5

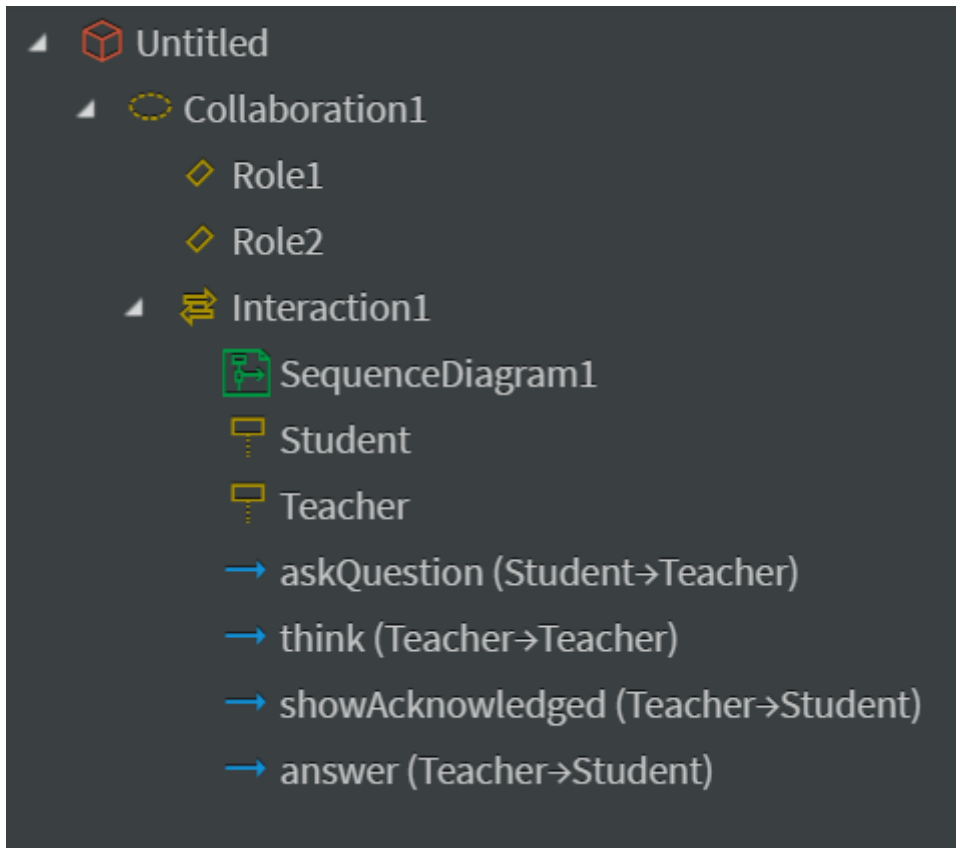
根据 UML 图回答问题。



1. 图中共有\_\_\_\_\_个生命线，\_\_\_\_\_个消息。
2. 图中类型为返回消息的消息是\_\_\_\_\_和\_\_\_\_\_。（填数字）

### 题目 6

根据下方的树形图回答问题。



1. 两条生命线的名字分别为\_\_\_\_\_和\_\_\_\_\_。
2. 消息 `showAcknowledged` 的方向是从\_\_\_\_\_到\_\_\_\_\_。
3. 基于上图中的图符类别来推理, `Role1` 和 `Role2` 在 mdj 中的 `_type` 字段为\_\_\_\_\_。

## 题目 7

根据给出的部分 mdj 源码回答问题。

```
1  {
2    "_type": "UMLModel",
3    "_id": "AAAAAAFF+qBWK6M3Z8Y=",
4    "_parent": {
5      "$ref": "AAAAAAFF+h6Sjam2Hec="
6    },
7    "name": "Model",
8    "ownedElements": [
9      {
10         "_type": "UMLClassDiagram",
11         "_id": "AAAAAAFF+qBtyKM79qY=",
12         "_parent": {
13           "$ref": "AAAAAAFF+qBWK6M3Z8Y="
14         },
15         "name": "Main",
16         "defaultDiagram": true
17       },
18       {
19         "_type": "UMLCollaboration",
20         "_id": "AAAAAAF8Jhs5paF768E=",
21         "_parent": {
22           "$ref": "AAAAAAFF+qBWK6M3Z8Y="
23         },
24         "name": "Collaboration1",
25         "ownedElements": [
```



```

26     {
27         "_type": "UMLInteraction",
28         "_id": "AAAAAAF8Jhs5paF8Srs=",
29         "_parent": {
30             "$ref": "AAAAAAF8Jhs5paF768E="
31         },
32         "name": "Interaction1",
33         "ownedElements": [],
34         "messages": [
35             {
36                 "_type": "UMLMessage",
37                 "_id": "AAAAAAF8JiCnTaHtsGU=",
38                 "_parent": {
39                     "$ref": "AAAAAAF8Jhs5paF8Srs="
40                 },
41                 "name": "Order",
42                 "source": {
43                     "$ref": "AAAAAAF8JhtBsaGLrOc="
44                 },
45                 "target": {
46                     "$ref": "AAAAAAF8Jhwv6GtYrA="
47                 }
48             },
49             {
50                 "_type": "UMLMessage",
51                 "_id": "AAAAAAF8JiRMlKIEeBw=",
52                 "_parent": {
53                     "$ref": "AAAAAAF8Jhs5paF8Srs="
54                 },
55                 "name": "Notice",
56                 "source": {
57                     "$ref": "AAAAAAF8Jhwv6GtYrA="
58                 },
59                 "target": {
60                     "$ref": "AAAAAAF8Jh3FpaHNxNg="
61                 }
62             },
63             {
64                 "_type": "UMLMessage",
65                 "_id": "AAAAAAF8JiqGBaI+A2s=",
66                 "_parent": {
67                     "$ref": "AAAAAAF8Jhs5paF8Srs="
68                 },
69                 "name": "make",
70                 "source": {
71                     "$ref": "AAAAAAF8Jh3FpaHNxNg="
72                 },
73                 "target": {
74                     "$ref": "AAAAAAF8Jh3FpaHNxNg="
75                 }
76             },
77             {
78                 "_type": "UMLMessage",
79                 "_id": "AAAAAAF8Ji1oxKKZog4=",
80                 "_parent": {
81                     "$ref": "AAAAAAF8Jhs5paF8Srs="
82                 },
83                 "name": "Sent",

```

```

84         "source": {
85             "$ref": "AAAAAAF8Jhwv6GtYrA="
86         },
87         "target": {
88             "$ref": "AAAAAAF8JhtBsagLrOc="
89         },
90         "messageSort": "reply"
91     }
92 ],
93 "participants": [
94     {
95         "_type": "UMLLifetime",
96         "_id": "AAAAAAF8JhtBsagLrOc=",
97         "_parent": {
98             "$ref": "AAAAAAF8Jhs5paF8Srs="
99         },
100         "name": "Customer",
101         "represent": {
102             "$ref": "AAAAAAF8JhtBsagK3FU="
103         },
104         "isMultiInstance": false
105     },
106     {
107         "_type": "UMLLifetime",
108         "_id": "AAAAAAF8Jhwv6GtYrA=",
109         "_parent": {
110             "$ref": "AAAAAAF8Jhs5paF8Srs="
111         },
112         "name": "waiter",
113         "represent": {
114             "$ref": "AAAAAAF8Jhwv6GsGtY="
115         },
116         "isMultiInstance": false
117     },
118     {
119         "_type": "UMLLifetime",
120         "_id": "AAAAAAF8Jh3FpaHNxNg=",
121         "_parent": {
122             "$ref": "AAAAAAF8Jhs5paF8Srs="
123         },
124         "name": "Cook",
125         "represent": {
126             "$ref": "AAAAAAF8Jh3FpaHMEog="
127         },
128         "isMultiInstance": false
129     }
130 ]
131 }
132 ],
133 "attributes": [
134     {
135         "_type": "UMLAttribute",
136         "_id": "AAAAAAF8JhtBsagK3FU=",
137         "_parent": {
138             "$ref": "AAAAAAF8Jhs5paF768E="
139         },
140         "name": "Role1"
141     },

```

```

142         {
143             "_type": "UMLAttribute",
144             "_id": "AAAAAAF8Jhvvv6GsGtY=",
145             "_parent": {
146                 "$ref": "AAAAAAF8Jhs5paF768E="
147             },
148             "name": "Role2"
149         },
150         {
151             "_type": "UMLAttribute",
152             "_id": "AAAAAAF8Jh3FpaHMEog=",
153             "_parent": {
154                 "$ref": "AAAAAAF8Jhs5paF768E="
155             },
156             "name": "Role3"
157         }
158     ]
159 }

```

1. 名为 `Sent` 的消息，`id` 为\_\_\_\_\_，类型为\_\_\_\_\_，其 `source` 对应的生命线为\_\_\_\_\_，`target` 对应的生命线为\_\_\_\_\_。（生命线填名字）
2. 生命线 `waiter` 总共有\_\_\_\_\_个发出的消息，\_\_\_\_\_个收到的消息。

## 题目 8

补全下面缺失部分的代码，其中消息 `Purchasinglist` 的意思是操作员向管理员发送购买清单消息。

```

1  {"_parent": "AAAAAAF8J/Igtxx8G1I=", "visibility": "public", "name": "Interaction1",
   , "_type": "UMLInteraction", "_id": "AAAAAAF8J/IguBx9v0w="}
2  {"messageSort": "synchCall", "_parent": "AAAAAAF8J/IguBx9v0w=", "visibility": "pub
   lic", "name": "Purchasinglist", "_type": "UMLMessage", "_id": "AAAAAAF8J/ZQoRztLuI=
   ", "source": "_____", "target": "_____"}
3  {"messageSort": "synchCall", "_parent": "AAAAAAF8J/IguBx9v0w=", "visibility": "pub
   lic", "name": "Buygoods", "_type": "UMLMessage", "_id": "AAAAAAF8J/egOx0EW3k=", "sou
   rce": "AAAAAAF8J/JOmByszSg=", "target": "AAAAAAF8J/KUQhzNu4Y="}
4  {"messageSort": "synchCall", "_parent": "AAAAAAF8J/IguBx9v0w=", "visibility": "pub
   lic", "name": "Reject", "_type": "UMLMessage", "_id": "AAAAAAF8KABjbh6iBFg=", "sourc
   e": "AAAAAAF8J/KUQhzNu4Y=", "target": "AAAAAAF8KABjbh6gBJU="}
5  {"messageSort": "synchCall", "_parent": "AAAAAAF8J/IguBx9v0w=", "visibility": "pub
   lic", "name": "Check", "_type": "UMLMessage", "_id": "AAAAAAF8J/wy/B5MmB0=", "source
   ": "AAAAAAF8J/JOmByszSg=", "target": "AAAAAAF8J/KUQhzNu4Y="}
6  {"_parent": "AAAAAAF8J/IguBx9v0w=", "visibility": "public", "name": "Operator", "_t
   ype": "_____", "isMultiInstance": false, "_id": "AAAAAAF8J/Iu8xyM5no=", "represen
   t": "AAAAAAF8J/Iu8hyLhZ8="}
7  {"_parent": "AAAAAAF8J/IguBx9v0w=", "visibility": "public", "name": "Administrator
   ", "_type": "UMLLifetime", "isMultiInstance": false, "_id": "AAAAAAF8J/JOmByszSg=",
   "represent": "AAAAAAF8J/JOmByrDNI="}
8  {"_parent": "AAAAAAF8J/IguBx9v0w=", "visibility": "public", "name": "Supplier", "_t
   ype": "UMLLifetime", "isMultiInstance": false, "_id": "AAAAAAF8J/KUQhzNu4Y=", "repr
   esent": "AAAAAAF8J/KUQhzMTKu="}
9  {"_parent": "_____", "visibility": "public", "name": "Endpoint1", "_type": "UMLEnd
   point", "_id": "AAAAAAF8KABjbh6gBJU="}

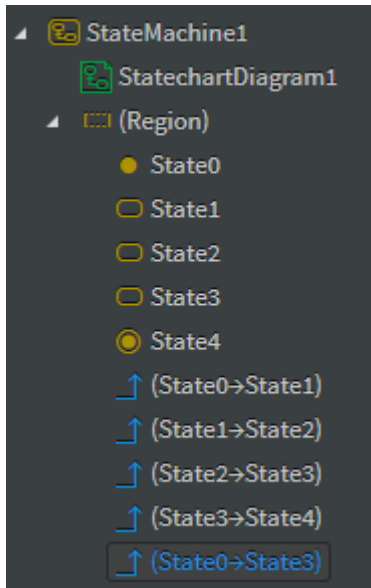
```

缺失部分应该依次填入\_\_\_\_\_、\_\_\_\_\_、\_\_\_\_\_、\_\_\_\_\_。

## 状态图训练题

## 题目 9

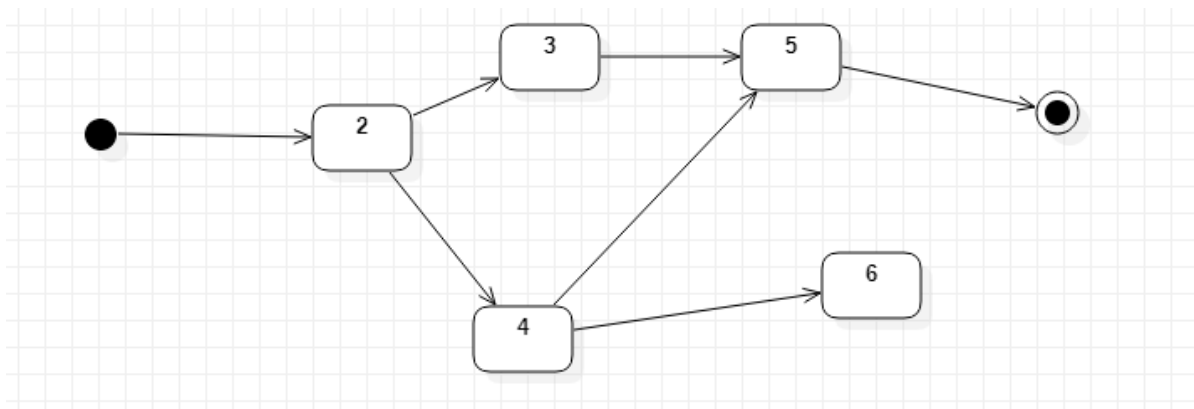
根据树形图回答问题。



1. 图中一共有\_\_\_\_\_个 UMLTransition。
2. 终止状态名称为\_\_\_\_\_，起始状态名称为\_\_\_\_\_。
3. 图中 state1 状态的可达状态集合为 {\_\_\_\_\_}。（按照名称字母序升序排列）

## 题目 10

读下方的 UML 图，回答问题。图中起始状态名字为 1，最终状态名字为 7。



1. 图中共有\_\_\_\_\_个 UMLTransition。
2. 状态 4 可以到达的状态集合为 {\_\_\_\_\_}，状态 2 可以直接到达的状态集合为 {\_\_\_\_\_}。

## 题目 11

读下方的 UML 源码，回答问题。

```
1 {
2     "_type": "UMLStateMachine",
3     "_id": "AAAAAAF8amEXEE4bBdo=",
4     "_parent": {
5         "$ref": "AAAAAAFF+h6Sjam2Hec="
6     },
7     "name": "StateMachine1",
8     "regions": [
```

```

9      {
10         "_type": "UMLRegion",
11         "_id": "AAAAAAF8amEXEE4cd04=",
12         "_parent": {
13             "$ref": "AAAAAAF8amEXEE4bBdo="
14         },
15         "vertices": [
16             {
17                 "_type": "UMLState",
18                 "_id": "AAAAAAF8amJGfU4i+bw=",
19                 "_parent": {
20                     "$ref": "AAAAAAF8amEXEE4cd04="
21                 },
22                 "name": "Login prompt"
23             },
24             {
25                 "_type": "UMLState",
26                 "_id": "AAAAAAF8amMxJk40L9E=",
27                 "_parent": {
28                     "$ref": "AAAAAAF8amEXEE4cd04="
29                 },
30                 "name": "verification"
31             },
32             {
33                 "_type": "UMLState",
34                 "_id": "AAAAAAF8amPFLk5b8mY=",
35                 "_parent": {
36                     "$ref": "AAAAAAF8amEXEE4cd04="
37                 },
38                 "name": "Loginfail"
39             },
40             {
41                 "_type": "UMLState",
42                 "_id": "AAAAAAF8amRlM06BEJs=",
43                 "_parent": {
44                     "$ref": "AAAAAAF8amEXEE4cd04="
45                 },
46                 "name": "ModifyPassword"
47             },
48             {
49                 "_type": "UMLState",
50                 "_id": "AAAAAAF8amSevU6owGg=",
51                 "_parent": {
52                     "$ref": "AAAAAAF8amEXEE4cd04="
53                 },
54                 "name": "Success"
55             }
56         ],
57         "transitions": [
58             {
59                 "_type": "UMLTransition",
60                 "_id": "AAAAAAF8amVXuE7TpcQ=",
61                 "_parent": {
62                     "$ref": "AAAAAAF8amEXEE4cd04="
63                 },
64                 "source": {
65                     "$ref": "AAAAAAF8amJGfU4i+bw="
66                 },

```

```

67         "target": {
68             "$ref": "AAAAAAF8amMxJk40L9E="
69         },
70         "stereotype": "",
71         "triggers": [
72             {
73                 "_type": "UMLEvent",
74                 "_id": "AAAAAAF8ampks09cSG8=",
75                 "_parent": {
76                     "$ref": "AAAAAAF8amVXuE7TpcQ="
77                 },
78                 "name": "Login"
79             }
80         ]
81     },
82     {
83         "_type": "UMLTransition",
84         "_id": "AAAAAAF8amWFS07nrGw=",
85         "_parent": {
86             "$ref": "AAAAAAF8amEXEE4cd04="
87         },
88         "source": {
89             "$ref": "AAAAAAF8amMxJk40L9E="
90         },
91         "target": {
92             "$ref": "AAAAAAF8amPFLk5b8mY="
93         }
94     },
95     {
96         "_type": "UMLTransition",
97         "_id": "AAAAAAF8amwbfk7460Y=",
98         "_parent": {
99             "$ref": "AAAAAAF8amEXEE4cd04="
100         },
101         "source": {
102             "$ref": "AAAAAAF8amMxJk40L9E="
103         },
104         "target": {
105             "$ref": "AAAAAAF8amSevU6owGg="
106         }
107     },
108     {
109         "_type": "UMLTransition",
110         "_id": "AAAAAAF8amXB0U8JsxM=",
111         "_parent": {
112             "$ref": "AAAAAAF8amEXEE4cd04="
113         },
114         "source": {
115             "$ref": "AAAAAAF8amPFLk5b8mY="
116         },
117         "target": {
118             "$ref": "AAAAAAF8amJGfU4i+bw="
119         },
120         "triggers": [
121             {
122                 "_type": "UMLEvent",
123                 "_id": "AAAAAAF8amwKvU9lnws=",
124                 "_parent": {

```

```

125         "$ref": "AAAAAAF8amXB0U8JsXM="
126     },
127     "name": "Fail"
128 }
129 ],
130 "effects": [
131     {
132         "_type": "UMLOpaqueBehavior",
133         "_id": "AAAAAAF8amxYVk9p/9s=",
134         "_parent": {
135             "$ref": "AAAAAAF8amXB0U8JsXM="
136         },
137         "name": "Retry"
138     }
139 ]
140 },
141 {
142     "_type": "UMLTransition",
143     "_id": "AAAAAAF8amYeCE8bD9E=",
144     "_parent": {
145         "$ref": "AAAAAAF8amEXEE4cd04="
146     },
147     "source": {
148         "$ref": "AAAAAAF8amPFLk5b8mY="
149     },
150     "target": {
151         "$ref": "AAAAAAF8amRlM06BEJs="
152     },
153     "triggers": [
154         {
155             "_type": "UMLEvent",
156             "_id": "AAAAAAF8am3ImU9vj7I=",
157             "_parent": {
158                 "$ref": "AAAAAAF8amYeCE8bD9E="
159             },
160             "name": "ForgetWord"
161         }
162     ]
163 },
164 {
165     "_type": "UMLTransition",
166     "_id": "AAAAAAF8amYn+k8sgdY=",
167     "_parent": {
168         "$ref": "AAAAAAF8amEXEE4cd04="
169     },
170     "source": {
171         "$ref": "AAAAAAF8amRlM06BEJs="
172     },
173     "target": {
174         "$ref": "AAAAAAF8amJGfU4i+bw="
175     },
176     "guard": "modify()"
177 },
178 {
179     "_type": "UMLTransition",
180     "_id": "AAAAAAF8am6Fok9zAWY=",
181     "_parent": {
182         "$ref": "AAAAAAF8amEXEE4cd04="

```

```

183         },
184         "source": {
185             "$ref": "AAAAAAF8amSevU6oWGg="
186         },
187         "target": {
188             "$ref": "AAAAAAF8amJGfU4i+bw="
189         },
190         "guard": "loginout()",
191         "triggers": [
192             {
193                 "_type": "UMLEvent",
194                 "_id": "AAAAAAF8am6ns0+EEFg=",
195                 "_parent": {
196                     "$ref": "AAAAAAF8am6F0k9zAWY="
197                 },
198                 "name": "Exit"
199             }
200         ]
201     }
202 ]
203 }
204 ]
205 }

```

1. 图中一共有\_\_\_\_\_个 `UMLTransition`，其中有\_\_\_\_\_个 `UMLTransition` 有事件标识（`UMLEvent`）。
2. 拥有 `UMLOpaqueBehavior` 的 `UMLTransition` 的 `id` 为\_\_\_\_\_，其 `source` 对应的状态为\_\_\_\_\_，`target` 对应的状态为\_\_\_\_\_。（填名称）
3. 从状态 `ModifyPassword` 到状态 `Login prompt` 的守护条件（`guard`）为\_\_\_\_\_。

## 题目 12

根据给出的部分 mdj 源码回答问题。

```

1  {
2      "_type": "UMLStateMachine",
3      "_id": "AAAAAAF8apVT71MJ7Ng=",
4      "_parent": {
5          "$ref": "AAAAAAFF+h6SjaM2Hec="
6      },
7      "name": "StateMachine1",
8      "regions": [
9          {
10             "_type": "UMLRegion",
11             "_id": "AAAAAAF8apVT71MKSos=",
12             "_parent": {
13                 "$ref": "AAAAAAF8apVT71MJ7Ng="
14             },
15             "vertices": [
16                 {
17                     "_type": "UMLPseudostate",
18                     "_id": "AAAAAAF8apWUrFMQq48=",
19                     "_parent": {
20                         "$ref": "AAAAAAF8apVT71MKSos="
21                     },
22                     "kind": "initial"

```



```

23     },
24     {
25         "_type": "UMLFinalState",
26         "_id": "AAAAAAF8apwbh1Mhac4=",
27         "_parent": {
28             "$ref": "AAAAAAF8apVT71MKSos="
29         }
30     },
31     {
32         "_type": "UMLState",
33         "_id": "AAAAAAF8apWpu1MmkwA=",
34         "_parent": {
35             "$ref": "AAAAAAF8apVT71MKSos="
36         },
37         "name": "State1"
38     },
39     {
40         "_type": "UMLState",
41         "_id": "AAAAAAF8apWwcFNLSv8=",
42         "_parent": {
43             "$ref": "AAAAAAF8apVT71MKSos="
44         },
45         "name": "State2"
46     },
47     {
48         "_type": "UMLState",
49         "_id": "AAAAAAF8apccN1NwPiQ=",
50         "_parent": {
51             "$ref": "AAAAAAF8apVT71MKSos="
52         },
53         "name": "State3"
54     },
55     {
56         "_type": "UMLState",
57         "_id": "AAAAAAF8apcillovr8k=",
58         "_parent": {
59             "$ref": "AAAAAAF8apVT71MKSos="
60         },
61         "name": "State4"
62     },
63     {
64         "_type": "UMLState",
65         "_id": "AAAAAAF8apcpmVO6TbQ=",
66         "_parent": {
67             "$ref": "AAAAAAF8apVT71MKSos="
68         },
69         "name": "State5"
70     }
71 ],
72 "transitions": [
73     {
74         "_type": "UMLTransition",
75         "_id": "AAAAAAF8apn091PfLX4=",
76         "_parent": {
77             "$ref": "AAAAAAF8apVT71MKSos="
78         },
79         "source": {
80             "$ref": "AAAAAAF8apWUrFMQq48="

```

```

81         },
82         "target": {
83             "$ref": "AAAAAAF8apwpu1MmkwA="
84         }
85     },
86     {
87         "_type": "UMLTransition",
88         "_id": "AAAAAAF8apnjm1PwoVE=",
89         "_parent": {
90             "$ref": "AAAAAAF8apVT71MKSos="
91         },
92         "source": {
93             "$ref": "AAAAAAF8apWUrFMQq48="
94         },
95         "target": {
96             "$ref": "AAAAAAF8apWwcFNLSv8="
97         }
98     },
99     {
100         "_type": "UMLTransition",
101         "_id": "AAAAAAF8apnujlQB9Sw=",
102         "_parent": {
103             "$ref": "AAAAAAF8apVT71MKSos="
104         },
105         "source": {
106             "$ref": "AAAAAAF8apwpu1MmkwA="
107         },
108         "target": {
109             "$ref": "AAAAAAF8apccN1NwPiQ="
110         }
111     },
112     {
113         "_type": "UMLTransition",
114         "_id": "AAAAAAF8apn3EFQSVpc=",
115         "_parent": {
116             "$ref": "AAAAAAF8apVT71MKSos="
117         },
118         "source": {
119             "$ref": "AAAAAAF8apWwcFNLSv8="
120         },
121         "target": {
122             "$ref": "AAAAAAF8apccN1NwPiQ="
123         }
124     },
125     {
126         "_type": "UMLTransition",
127         "_id": "AAAAAAF8apoCqVQj6NI=",
128         "_parent": {
129             "$ref": "AAAAAAF8apVT71MKSos="
130         },
131         "source": {
132             "$ref": "AAAAAAF8apccN1NwPiQ="
133         },
134         "target": {
135             "$ref": "AAAAAAF8apcillovr8k="
136         }
137     },
138     {

```

```

139         "_type": "UMLTransition",
140         "_id": "AAAAAAF8apoKeFQ0X7A=",
141         "_parent": {
142             "$ref": "AAAAAAF8apVT71MKSos="
143         },
144         "source": {
145             "$ref": "AAAAAAF8apccN1NwPiQ="
146         },
147         "target": {
148             "$ref": "AAAAAAF8apcpmV06TbQ="
149         }
150     },
151     {
152         "_type": "UMLTransition",
153         "_id": "AAAAAAF8apoaJ1RfYk=",
154         "_parent": {
155             "$ref": "AAAAAAF8apVT71MKSos="
156         },
157         "source": {
158             "$ref": "AAAAAAF8apci1lovr8k="
159         },
160         "target": {
161             "$ref": "AAAAAAF8apwbh1Mhac4="
162         }
163     },
164     {
165         "_type": "UMLTransition",
166         "_id": "AAAAAAF8apokyFRWqkQ=",
167         "_parent": {
168             "$ref": "AAAAAAF8apVT71MKSos="
169         },
170         "source": {
171             "$ref": "AAAAAAF8apcpmV06TbQ="
172         },
173         "target": {
174             "$ref": "AAAAAAF8apwbh1Mhac4="
175         }
176     }
177 ]
178 }
179 ]
180 }

```

该状态机的**关键状态**为\_\_\_\_\_（填名称，如果不存在**关键状态**则填无）。

对于**关键状态**的解释：

- 删除某个状态之后无法从 Initial State 到达任意一个 Final State，且不与下一条规定相悖，则该状态是关键状态。
- 如果状态机模型本来就无法从 Initial State 到达任意一个 Final State，则该状态机中所有状态都不是关键状态。

## 提交方式

注意到每一题有标注序号，根据下文给出的模板和参考示例（仅有格式参考作用，无实际含义）保存在第四单元训练仓库的根目录的 `answer.json` 文件内，并在 course 平台提交该 commit。

```
1  {
2      "1": [
3          "第二题第一空内容",
4          "第二题第二空内容",
5          "第二题第三空内容",
6          "第二题第四空内容",
7          "第二题第五空内容",
8          "第二题第六空内容",
9          "第二题第七空内容"
10     ],
11     "2": [
12         "第二题第一空内容",
13         "第二题第二空内容",
14         "第二题第三空内容",
15         "第二题第四空内容",
16         "第二题第五空内容",
17         "第二题第六空内容"
18     ],
19     "3": ["第三题第一空内容", "第三题第二空内容"],
20     "4": [
21         "第四题第一空内容",
22         "第四题第二空内容",
23         "第四题第三空内容",
24         "第四题第四空内容",
25         "第四题第五空内容",
26         "第四题第六空内容"
27     ],
28     "5": [
29         "第五题第一空内容",
30         "第五题第二空内容",
31         "第五题第三空内容",
32         "第五题第四空内容"
33     ],
34     "6": [
35         "第六题第一空内容",
36         "第六题第二空内容",
37         "第六题第三空内容",
38         "第六题第四空内容",
39         "第六题第五空内容"
40     ],
41     "7": [
42         "第七题第一空内容",
43         "第七题第二空内容",
44         "第七题第三空内容",
45         "第七题第四空内容",
46         "第七题第五空内容",
47         "第七题第六空内容"
48     ],
49     "8": [
50         "第八题第一空内容",
51         "第八题第二空内容",
52         "第八题第三空内容",
53         "第八题第四空内容"
54     ],
55     "9": [
56         "第九题第一空内容",
57         "第九题第二空内容",
58         "第九题第三空内容",
```

```
59         "第九题第四空内容"
60     ],
61     "10": ["第十题第一空内容", "第十题第二空内容", "第十题第三空内容"],
62     "11": [
63         "第十一题第一空内容",
64         "第十一题第二空内容",
65         "第十一题第三空内容",
66         "第十一题第四空内容",
67         "第十一题第五空内容",
68         "第十一题第六空内容"
69     ],
70     "12": "第十二题第一空内容"
71 }
```